Abstract submission to SPIE Astronomical Telescopes and Instrumentation Symposium, 20-28 March, 1998, Kona, Hawaii

1. SUBMIT TO: AS02, REASENBERG/SHAO

2. COFERENCE: Astronomical Interferometry

3. ABSTRACT TITLE: **Thermal Modeling of a Space Interferometer Siderostat Bay**

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5. PRESENTATION: Oral Presentation

6. ABSTRACT TEXT: See next page

7. KEYWORDS: Thermal, siderostat, modeling, stability, radiation

8. BRIEF BIOGRAPHY:

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Thermal Modeling of a Space Interferometer Siderostat Bay

by

Edward I. Lin

Abstract

Thermal stability of critical instrument components is of serious concern for the Space Interferometer Mission (SIM). Within the SIM siderostat bay, thermal distortion of the siderostat mirror and the telescope primary and secondary mirrors must be controlled to ensure success of the mission,

This paper will describe the thermal (TRASYS and SINDA) models that have been developed based on the current baseline configuration of the SIM siderostat bay. Preliminary analytical results from exercising the models have indicated that temperature gradients across the optical components are unavoidable but can be minimized with suitable designs. Depending on the spacecraft orientation relative to the Sun and Earth, nominal bay temperatures can range between +60°C and -70°C, and the radiant heat from the Sun and Earth that penetrates through a conventional 20-layer MLI blanket into the bay, can total 30 W or more. Preliminary results also show that a large sunshade, strategically placed between the Sun and the siderostat bay to reduce effects of orbital heating variation (one of the mission design options being considered), can drive the nominal bay temperatures **down by a substantial amount (50°C or more), thereby raising heater power requirements.**

The models have been and will continue to be used to analyze design strategies and compare design options, evaluate and help determine the Sun and Earth exclusion angles, calculate heater power requirements, explore innovative techniques for promoting temperature uniformity within the bay enclosure, and assess temperature stability of critical components under various observation scenarios and orbital conditions (including the low Earth orbit and Earth trailing orbit). Some of these results will be presented in the paper.